shares.[29]

The key to this conclusion is that providers are legally able to shift or substitute rapidly among the various services available for provision, and can do so at modest cost. If all firms can easily offer the same range of services, they are in the same market.

A number of factors support the view that all mobile service providers -- cellular, PCS, and ESMR -- are in the same market:[30] (1) the absence of legal or regulatory restrictions on spectrum use, permitting a licensee to shift from provision of one mobile service to another in response to a service price increase; (2) the ability to use all portions of the electromagnetic spectrum allocated to the provision of mobile services to provide all of the same services and at similar costs ("bandwidth fungibility"); (3) the ability of suppliers to obtain equipment that can be used to provide more than one service, a factor that will be enhanced by the introduction of Cellular Digital Packet Data (CDPD) modules; and (4) the ability of consumers to obtain equipment that can be used to obtain service from suppliers using different frequencies, a factor that is enhanced by the FCC's decision to consolidate PCS assignments in a continuous band.

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[29]It must be noted that there is not a one-to-one correspondence between bandwidth and capacity. The capacity to transmit information is a function both of bandwidth and the technology used; analog technologies are inherently less capable than digital technologies. Capacity is based on effective bandwidth.

[30]Besen and Burnett, op. cit., discusses these factors in more detail.

After the market is defined, shares must then be assigned to each supplier in order to measure market concentration. As mentioned above, effective capacity to transmit information is the appropriate measure of market shares within the market for mobile telecommunications services, particularly given the ease with which firms may switch from the provision of one service to another.[31] The decision by the Commission to award licenses to PCS providers, combined with the introduction of ESMR, will greatly expand the number of firms supplying mobile telecommunications services in each geographic area within the United States and will dramatically reduce the level of market concentration.

Measuring the magnitude of the change can be demonstrated by comparing the current Herfindahl-Hirschman Index (HHI), the sum of the squared market shares of the incumbent cellular operators, with the HHI that will prevail after the introduction of PCS and ESMR.[32] The current HHI is 5000, since each of the incumbents has

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[31]Within a given allotment of spectrum, newer, digital systems have a far greater capacity than do older, analog ones. Because incumbent cellular operators will, for some time, be required to continue to serve customers that have invested in analog equipment, they will have lower effective capacity and market share per unit of allocated bandwidth than will firms with licenses for the same amount of bandwidth that employ only digital equipment. Existing cellular operators will suffer this "analog handicap" for as long as they must serve customers using the old technology. The share of the mobile telecommunications market held by cellular firms will be less than their share of assigned bandwidth, and this factor must be taken into account in measuring market concentration and the effects of spectrum license acquisitions.

[32]The HHI is the most widely used measure of market concentration and appears prominently in the DOJ/FTC Horizontal Merger Guidelines.

one-half of industry capacity.[33] The significant reduction in the HHI that will accompany the introduction of PCS and ESMR can be expected to increase industry competitiveness.

Ignoring ESMR for the moment and concentrating solely on PCS, the "worst," i.e., most concentrated, case, occurs where each of three newcomers acquires licenses to use both a 30 MHz and a 10 MHz assignment, the maximum bandwidth that can be acquired under FCC rules. Even in this case, the HHI declines by more than half to 2278.[34] Significantly, the cellular carriers each have only about 11 percent of industry capacity while each of the newcomers has more than 26 percent.

In the "best," i.e., least concentrated, case, three new licensees each have a 30 MHz allocation and three new licensees each have a 10 MHz allocation. In these circumstances, the HHI is 1514, less than one-third of what it had previously been[35], with the cellular carriers again each having only an 11 percent share.

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[33]The HHI is calculated as $2(50)^2$, since each of the two cellular suppliers is licensed to use 50 percent of industry capacity. In this calculation, we ignore the presence of other suppliers of mobile services, which has the effect of increasing the HHI.

[34]This assumes that digital capacity has 6 times the throughput as analog and that the incumbent cellular carriers must reserve 10 MHz to service customers using analog equipment. The details of this and the following calculations are presented in Tables 1 and 2. D.P. Reed, Putting It All Together: The Cost Structure of Personal Communications Services (Federal Communications Commission, Office of Plans and Policy, November 1992, pp. 66-69) provides references to many of the estimates of the advantages of digital over analog transmission.

[35]Actually, concentration can be less than this if the initial PCS licenses are subdivided. The calculations presented here are conservative in that they assume no subdivision occurs.

Indeed, even if a cellular carrier were to acquire a 10 MHz allocation, the maximum it can obtain, its share would rise to somewhat less than 18 percent, which would still be smaller than the share of each of the three newcomers with a 30 MHz allocation.[36]

When ESMR is taken into account, the market becomes even less concentrated. If the ESMR is assigned a bandwidth of 10 MHz, the worst case HHI is 2045 and the best case HHI is only 1370. Here, the share of an incumbent cellular carrier is reduced to only about 10 percent if it does not acquire a 10 MHz license, and it is somewhat less than 17 percent if it does. By contrast, a PCS newcomer with a 30 MHz license has a share of more than 18 percent, while one with both a 30 MHz and a 10 MHz license has a share of more than 24 percent.

These calculations strongly support two conclusions. First, overall industry concentration will decline greatly as the result of the introduction of PCS and ESMR, with the precise extent determined by the identities of the successful bidders in the PCS auctions and on transactions in the aftermarket. In no case does the HHI fall by less than half, and it could decline by more than two-thirds. Second, the shares of the incumbent cellular operators, as measured by their shares of effective capacity, will

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[36]The reason, as mentioned, is the continuing analog obligation.

decline precipitously with the introduction of PCS and ESMR.[37]

Conclusion

We are about to enter a new era in which the number of firms supplying mobile telecommunications services will more than double, effective industry capacity will increase more than fourfold, measured industry concentration will decline by more than half, and the share of the effective capacity of the industry licensed to each of the two current cellular providers will decline by more than two-thirds. As the number of carriers increases, and industry concentration as measured by the HHI declines, the industry is likely to become more competitive. Given the quite remarkable performance of the cellular industry with only two carriers and much more limited capacity, the future of the mobile services industry is likely to be especially bright, with firms offering a wide array of new services and even lower prices than in the past for existing ones. In these circumstances, the best approach for regulators is to eliminate regulatory-imposed barriers to entry as rapidly as possible so that competitive market forces can determine the performance of the industry. Regulators would be at odds with developing market forces if they were to impose more stringent

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[37]We do not mean to suggest that the newcomers share of output will increase as rapidly as will their share of capacity. The point is, rather, that the existence of this large amount of capacity will immediately serve to discipline the pricing behavior of the incumbent cellular operators. The behavior of their output shares will depend in part on how they adjust their prices to the new entry. It should also be emphasized here that prices will likely fall simply because of the large increase in capacity.

requirements on cellular carriers just as industry concentration is declining so dramatically.

Table 1

HHI Calculations Without ESMR

Digital : Analog / 6 : 1

Cellular Operators' Bandwidth Devoted to Analog : 10 MHz

Firms	Bandwidth	Effective Capacity*	Market Share	HHI Contribution	Bandwidth	Effective Capacity*	Market Share	HHI Contribution
Cellular 1	25	100	10.9%	118	25	100	10.9%	118
Cellular 2	25	100	10.9%	118	25	100	10.9%	118
3	30	180	19.6%	383	40	240	26.1%	681
4	30	180	19.6%	383	40	240	26.1%	681
5	30	180	19.6%	383	40	240	26.1%	681
6	10	60	6.5%	43	0	0	0.0%	0
7	10	60	6.5%	43	0	0	0.0%	0
8	10	60	6.5%	43	0	0	0.0%	0
Totals	170	920		1,512	170	920		2,278

* Effective Capacity is defined as bandwidth devoted to digital multiplied by the ratio of digital's advantage over analog plus bandwidth devoted to analog.

SOURCES: FCC, Second Report and Order; Charles River Associates.

Table 2

HHI Calculations With ESMR

Digital : Analog / 6 : 1

Cellular Operators' Bandwidth Devoted to Analog : 10 MHz

Firms	Bandwidth	Effective Capacity*	Market Share	HHI Contribution	Bandwidth	Effective Capacity*	Market Share	HHI Contribution
Cellular 1	25	100	10.2%	104	25	100	10.2%	104
Cellular 2	25	100	10.2%	104	25	100	10.2%	104
3	30	180	18.4%	337	40	240	24.5%	600
4	30	180	18.4%	337	40	240	24.5%	600
5	30	180	18.4%	337	40	240	24.5%	600
6	10	60	6.1%	37	0	0	0.0%	0
7	10	60	6.1%	37	0	0	0.0%	0
8	10	60	6.1%	37	0	0	0.0%	0
ESMR 1	10	60	6.1%	37	10	60	6.1%	37
Totals	180	980		1,370	180	980		2,045

* Effective Capacity is defined as bandwidth devoted to digital multiplied by the ratio of digital's advantage over analog plus bandwidth devoted to analog.

SOURCES: FCC, Second Report and Order; Charles River Associates.

DECLARATION

I, Carl Povelites, Manager - Regulatory and Legislative Affairs for GTE Mobile Communications Service Corporation, do hereby declare under penalty of perjury that I have read the foregoing "Comment of GTE Service Corporation, on behalf of GTE Mobilnet of Hawaii Incorporated and GTE Hawaiian Telephone Company Incorporated in Opposition to the Petition of the Public Utilities Commission, State of Hawaii for Authority to Extend its Rate Regulation of Commercial Mobile Radio Services in the State of Hawaii ("Comment"), that the Comment was prepared under my supervision and direction, and that the facts contained therein are true and correct to the best of my knowledge, information or belief.

9/16/94

Carl Povelites

CERTIFICATE OF SERVICE

I, Donald J. Evans, do hereby certify that a copy of the foregoing **"Comment of GTE Service Corporation on Behalf of GTE Mobilnet of Hawaii Incorporated and GTE Hawaiian Telephone Company in Opposition to The Petition of The Public Utilities Commission, State of Hawaii for Authority to Extend its Rate Regulation of Commercial Mobile Radio Services in The State of Hawaii"** was mailed by First Class U.S. Mail, postage prepaid, this 19th day of September, 1994, to the following:

Yukio Naito, Chairman
Public Utilities Commission
State of Hawaii
465 South King Street
Kekuanaoa Building, #103
Honolulu, Hawaii 96813

Donald J. Evans